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NEW ZEALAND MARINE DEPARTMENT

FISHERIES TECHNICAL REPORT

NO.17

Investigations into the Effectiveness of Escape Gaps in Crayfish Traps

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FISHERIES TECHNICAL REPORT

INVESTIGATIONS INTO THE EFFECTIVENESS OF ESCAPE GAPS IN CRAYFISH TRAPS

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INVESTIGATIONS INTO THE EFFECTIVENESS OF ESCAPE GAPS IN CRAYFISH TRAPS

INTRODUCTION

Conservation of crayfish is thought possible by the use of escape gaps in crayfish traps. As yet these escape gaps are not in widespread use throughout New Zealand, and these investigations were conducted to test the effectiveness of the gaps in liberating undersized crayfish before the traps are brought to the surface.

It is now mandatory for craytraps to be fitted with escape gaps in Western Australian waters.

Crayfish and crayfish tails are New Zealand's principal fisheries export, and for 1965 exports were valued at £1,973,418. The quantity of crayfish landed from many New Zealand fishing grounds has stabilised over the past few years, and the annual landings for the years 1961-5 are given in Table 1.

TABLE 1

QUANTITY AND VALUE OF CRAYFISH LANDINGS

Year	Quantity (cwt)	Value (£s)
1961	79,398	847,159
1962	90,018	1,070,888
1963	89,449	940,730
1964	90,307	1,157,488
1965	97,933	1,634,797

The 1965 figure is 32,882 cwt lower than the record catch in 1956 (130,815 cwt) but is the highest since 1957 and it appears that the catches are increasing at the present time. It should also be noted that the value of crayfish has risen in recent years. In the areas under investigation, at Picton, Kaikoura and Motonau, fishermen have stated that they have been forced to locate new fishing areas and many are using far more traps than they did 5 years ago to take a catch of the same value.

The project was carried out as a summer vacation job between November 1966 and January 1967 at 3 crayfishing centres in the South Island, viz. Picton, Kaikoura and Motunau Island (see Fig.1). These areas were chosen because no work of this nature had been carried out here previously by other workers in the field (Messrs R. Street, L. Ritchie and Dr R.B. Pike). This work is not complete in itself but is intended to supplement information already gained elsewhere.

AREAS SAMPLED

The investigations were carried out in the following areas:-

1. PICTON

Fishing was undertaken off Cape Campbell and southwards for about 2 miles. Here the boats make 3-day trips out of Port Underwood, e.g. leave Sunday morning and return Tuesday afternoon. The crayfish are packed in cases at sea and kept alive by being left afloat at the anchorage.

2. KAIKOURA

Fishing was undertaken on the northern side of the peninsula on two reef formations known as the "Rubys" and the "Ninepins". Here, only day trips are made. (Fig.1).

3. MOTUNAU

Fishing here was carried out to the eastern (seaward) and southern sides of Motunau Island. Boats based here must anchor in the river and this means that fishing times must be correlated with the tide as boats can only enter and leave the river two hours either side of high tide. It was usual to leave on one tide and return on the next.

METHODS

The investigations were completed on commercial boats during normal fishing operations. Each boat was equipped with a winch for hauling up the traps. The winches were either driven off

the boat's motor or powered electrically.

The total length of crayfish caught in the traps under investigation was determined by using a wooden ruler. Measurements were made in centimetres. The total length of a crayfish is defined as the distance between the anterior tip of the median rostral spine (horn) and the posterior end of the telson (middle component of the tail fan) as measured along the dorsal surface when the crayfish is laid out flat. Measurements, whenever possible were completed at sea, assoon as possible after each trap was lifted. Undersize crayfish (less than the minimum legal size of 25.4 cm) were then returned to the sea. There were many days, due to very rough weather, when conditions were such that no measurements were possible during fishing operations and only observations (concerning numbers of crayfish, length of time trap set, etc.) could be noted. Unfortunately, it was not possible to measure the catch after reaching port because on all the boats worked, the catch was packed in cases as fishing was carried out.

The sampling technique was basically the same in all areas. At Cape Campbell the traps were set in lines in about 15 fathoms of water with the aid of an echo sounder. Here only 3 traps fitted with escape gaps could be used and these were placed alternately with 3 local unmodified traps as controls. At Kaikoura the traps were set in groups in 5-10 fathoms without the aid of an echo sounder. Nine escape traps were positioned randomly amongst the local traps. At Motunau the traps were set in lines in about 10-15 fathoms of water. The nine escape traps were randomly distributed among 9 local traps.

DESCRIPTION OF TRAPS

1. LOCAL TRAPS

The crayfish traps used by the fishermen in each area had no specially constructed escape gaps. The type of trap used in each area is described.

(a) PICTON: The predominent traps used were constructed of cane. They were approximately circular, about 4 feet in diameter, twenty inches deep, with a circular neck ranging from 10-12 inches in diameter and with a depth of 4 inches. They were weighted either with bricks or with concrete poured into the bottom centre. They had doors situated on the sides to facilitate emptying the catch. On the average, the cane was spaced about 1½ inches apart.

(b) KAIKOURA AND MOTUNAU: The majority of the traps in these two areas are constructed of supplejack. They are approximately 3 feet in diameter and 18 to 20 inches deep. The neck is circular, 12 inches in diameter and 2 to 3 inches deep. The traps are either weighted with concrete or with iron laced into the bottom of the trap. They have no doors. On the average, the supplejack was spaced about 1½ to 2¼ inches apart.

2. EXPERIMENTAL TRAPS

During the course of investigations two types of traps with escape gaps incorporated in them (called escape traps) were used.

(a) Wire Mesh traps were used in all 3 areas investigated. The traps were constructed of a ⅜ inch steel rod frame covered with 1⅝ inch mesh wire netting. They were 3 ft square at the base and 2ft 6inches square at the top by 2 feet deep. The neck, which was made of wood laced into the trap, was 10" square by 2½" deep. Two escape gaps, measuring 16" x 23/16th", were located at opposite sides of the trap at the base (Fig.2).

(b) Supplejack traps were used only at Kaikoura and Motunau. They were of the supplejack type commonly in use at Kaikoura. Two escape gaps were located on opposite sides of the trap near the base. The gaps were 16" x 23/16ths".

The gaps in these supplejack traps were hard to maintain at a constant size, but were checked as often as possible for variation.

RESULTS

Unfortunately, the whole of this project was severely handicapped by bad weather and this is reflected in the results. No results of any value were obtained from Kaikoura. Here the traps were set and could not be collected until 10 days later. By this time there were no fish left in the traps.

The individual lengths of each crayfish measured at Cape Campbell and Motunau Island are set out in Tables 2 and 3.

For Cape Campbell, where only steel traps were used, length frequency histograms based on I.C.M. size groups for non escape and escape traps are plotted in Figures 3 and 4.

For Motunau Island the length frequency histograms are shown as Figures 5 and 6.

Most of the crayfish at Cape Campbell were between 23.4 and 24.3 cm in length (21.1% of total). At Motunau the situation was slightly more complex. With the local traps, the largest size group was 24.4 to 25.3 cm but with the escape traps it was 29.4 to 30.3 cm. At Cape Campbell 85% of the fish caught in local traps were undersize (less than 25.4 cm) and at Motunau 74.4% of the crayfish caught in the escape traps were undersize, with the greatest majority in most cases being only slightly undersize (between 20.3 and 25.3 cm). In both areas there were very few large crayfish (greater than 28 cm) caught. All those that were this size were male. At Cape Campbell most of the small (undersize) crayfish were also male but at Motunau the sex ratio of undersize crayfish was fairly even.

DISCUSSION

To test whether the differences between the catches of the traps was significantly different it was assumed that the catches approximate a Poisson distribution. This will only be valid providing that the entry of any particular crayfish into a trap is independent of whether or not there are already crayfish in that trap; and this would appear to be valid because -

(a) Often there is still bait left in the trap when the trap is hauled up;
(b) the trap is large enough to hold far more crayfish than is usually caught.

The data was tested at the 5% probability level, using table 36A in "Biometrica Tables for Statisticians", as set out below:-

CAPE CAMPBELL

Undersize Fish			Oversize Fish		
Day	Escape Trap	Local Trap	Day	Escape Trap	Local Trap
1	7	29	1	5	3
2	6	4	2	2	3
3	2	6	3	2	1
4	14	23	4	4	6
	29	62		13	13

Significantly less undersize crayfish in escape traps.

No difference between the catches.

MOTUNAU

Undersize Fish			Oversize Fish		
Day	Escape Trap	Local Trap	Day	Escape Trap	Local Trap
1	0	9	1	6	25
2	2	30	2	8	19
3	0	0	3	5	50
	2	39		19	50

Significantly less undersize crayfish in escape traps.

Significantly less legal fish in escape traps.

At Cape Campbell the results show quite a significant difference in the catch between escape traps and non-escape traps. The difference is not in the number of legal fish caught but in the significantly fewer undersized crayfish caught by the escape traps.

At Motunau Island the results are very inconclusive and the escape traps could not be considered a success in this area. The escape traps caught significantly more legal size crayfish than did the escape traps.

Sea lice are common in this area. It is possible that they entered the traps first and then after having consumed the bait, left. This could be the reason for the bait being consumed rapidly with smaller catches of crayfish resulting.

Factors which could influence the liberation of small crayfish include -

1. AMOUNT OF BAIT: Although no actual figures were obtained it was observed that those traps which were lightly baited (2-3 gurnard frames per trap) caught less small crayfish than those traps that were heavily baited (4-5 gurnard frames per trap). It is probable that whilst there is still bait left in the trap the crayfish have no inclination to leave it, i.e. they use it as a daytime shelter. It is probable that in most areas the amount of bait per trap could be reduced without affecting the catch in any way.

2. LENGTH OF TIME THE TRAP IS FISHING: It was observed that when certain traps could not be picked on certain days (due to rough seas, etc.) that the numbers of small crayfish in these escape traps were reduced when picked the next day. This is probably tied up with the fact that all the bait is consumed and the small crayfish leave the trap.

3. TOTAL AREA OF ESCAPE GAP: Many commercial supplejack and cane traps had relatively large gaps between the cane - from $1\frac{1}{2}$" - $2\frac{1}{4}$". This must allow a certain amount of liberation of small crayfish.

Some traps at Motunau (those of Mr R. Turner) had the supplejack regularly spaced at 2½" and these pots seemed to liberate the small crayfish more effectively than the traps fitted with only 2 gaps (16" x 23/16th"). This means that not only is the vertical dimension of the gap critical but the total area of the gap is also of great importance.

4. POSITION OF BRIDLE: With the steel-framed escape traps the position of the bridle seemed to affect the extent of liberation of the undersize crayfish. The best results were obtained when the bridle was positioned at the bottom of the trap so that the trap was pulled up at a steep angle (more or less on its side, Fig. 7-A), therefore having one gap facing almost straight downwards. When the bridle was attached across the top of the trap so that it was pulled straight up the extent of liberation was not so great (Fig.7-B).

CONCLUSIONS

CAPE CAMPBELL: This area is notorious locally for the numbers of small crayfish. Most crayfish caught in this area were just undersize and this perhaps is a good sign for the future fishing in the area, assuming that this is not the average maximum size to which the crayfish in this area grow. However, there appears to be no reason to believe that this is true.

From the data obtained in respect of Cape Campbell it can be seen that the escape traps caught significantly less small crayfish than did the local traps although there was no difference in the legal catch. However, this fact is quite important to the fisherman because it saves a considerable amount of time when it comes to sorting the catch. Of course, the liberation of small crayfish before the catch is brought to the surface is also better for the crayfish population because small crayfish when lying on the deck awaiting sorting, must suffer a certain amount of physical and physiological damage before being returned to the sea. The time

interval between being caught and returned is often considerable and this means that the crayfish may be thrown back where the environment is unsuitable for them, e.g. mud bottom. This is especially true on boats with no echo-sounder.

MOTUNAU: In this area the data seems to be conflicting. The traps fitted with escape gaps caught significantly less undersize crayfish but the local traps caught significantly more legal crayfish. The only practical conclusion that can be drawn from this is that here the local traps fish better than do the escape gaps, as their construction allows for the escape of crayfish between the rings of supplejack.

As was found at Cape Campbell the majority of the fish caught at Motunau were undersize. This would appear to augur well for the future crayfish population provided efficient conservation methods are put into practice.

It must be stated that the data collected during this investigation was severely limited by long periods of bad weather but the figures that were obtained cast some doubts on the usefulness of escape gaps in crayfish traps and it is the opinion of the author that more work is necessary on the subject.

ACKNOWLEDGEMENTS

I would like to thank Messrs P. Parks, A. Alderidge and D. Buckland of Picton; Mr B. Smith of Kaikoura; Messrs R. and P. Turner and Mr H. Rudkin of Christchurch, for their valuable assistance and helpful advice, without which these investigations could not have been carried out.

APPENDIX

This is a summary of various fishermen's comments on the usefulness of escape gaps.

Many fishermen when making their traps space the cane or supplejack at distances ranging from $1\frac{3}{4}$ - $2\frac{1}{4}$". This, of course, gives a large total gap area. Even though these gaps are not of fixed size, the fishermen argue that this should allow more liberation of small crayfish than would one or two gaps of constant size per trap. Others think that escape gaps can be of no practical value since crayfish can leave the trap via the entrance. They believe this to be true because it is often found that when traps which have no bait at all left in them are pulled up there are no crayfish in them. This is the reason why they bait traps so heavily.

Another objection is that while the trap is being pulled up only a few crayfish will escape through the gaps for they will become blocked. However, R. Street does not agree with this (refer Fisheries Technical Report No.14).

One other fisherman has another theory on the usefulness of gaps in traps. He has made some traps with the supplejack spaced $2\frac{1}{2}$ - 3" apart. This is to allow free access of crayfish into the trap which is heavily baited. When the trap is pulled the crayfish spread out their legs and hold on, making no attempt to escape. These traps were only observed being pulled once, and on this occasion the catch was well above average.

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N.Z. Marine Department 1966 — Report on Fisheries for 1965. (Extract from Annual Report of the Marine Department). 27 pp.

Ritchie L.D. 1966 — Crayfish Pot Escapement Gap Survey; November 1965 - January 1966: N.Z. Marine Department, Fish. Tech. Report No.14. 24 pp.

Street R.J. 1966 — Experiments with Escape Gaps in Crayfish Pots. Commercial Fishing 4(9):10-1

TABLE 2.

LENGTH OF CRAYFISH CAUGHT IN TRAPS AT CAPE CAMPBELL.

CM SIZE GROUP	NUMBER OF CRAYFISH		% OF TOTAL		
	LOCAL TRAP	ESCAPE TRAP	LOCAL TRAP	ESCAPE TRAP	
18.4-19.3	2	4	2.7	9.3	
19.4-20.3	0	2	0	4.7	
20.4-21.3	7	1	9.6	2.3	
21.4-22.3	12	5	16.5	11.6	
22.4-23.3	14	5	19.2	11.6	
23.4-24.3	19	7	26.0	16.3	
24.4-25.3	8	8	11.0	18.6	Undersize
25.4-26.3	3	4	4.1	9.3	Legal
26.4-27.3	2	2	2.7	4.7	
27.4-28.3	2	1	2.7	2.3	
28.4-29.3	2	2	2.7	4.7	
29.4-30.3		2		4.7	
30.4-31.3					
31.4-32.3	1		1.4		
32.4-33.3					
33.4-34.3					
35.4-36.3	1		1.4.		
36.4-37.3					
37.4-38.3					
38.4-39.3					
Totals	73	43			

TABLE 3.

LENGTH OF CRAYFISH CAUGHT IN TRAPS AT MOTUNAU ISLAND

CM SIZE GROUP	NUMBER OF CRAYFISH		% OF TOTAL	
	LOCAL TRAP	ESCAPE TRAP	LOCAL TRAP	ESCAPE TRAP
18.4-19.3	1		1.2	
19.4-20.3	2		2.3	
20.4-21.3	0		0	
21.4-22.3	7		7.9	
22.4-23.3	6	2	6.8	9.1
23.4-24.3	10		11.4	
24.4-25.3	17		19.3	Undersize
				Legal
25.4-26.3	13	3	14.8	13.6
26.4-27.3	13	4	14.8	18.2
27.4-28.3	1	2	1.2	9.1
28.4-29.3	2	1	2.3	4.6
29.4-30.3	6	8	6.8	36.2
30.4-31.3	5	1	5.7	4.6
31.4-32.3	2	1	2.3	4.6
32.4-33.3	2		2.3	
33.4-34.3				
34.4-35.3				
35.4-36.3	1		1.2	
36.4-37.3				
37.4-38.3				
38.4-39.3	1		1.2	
Totals	89	22		

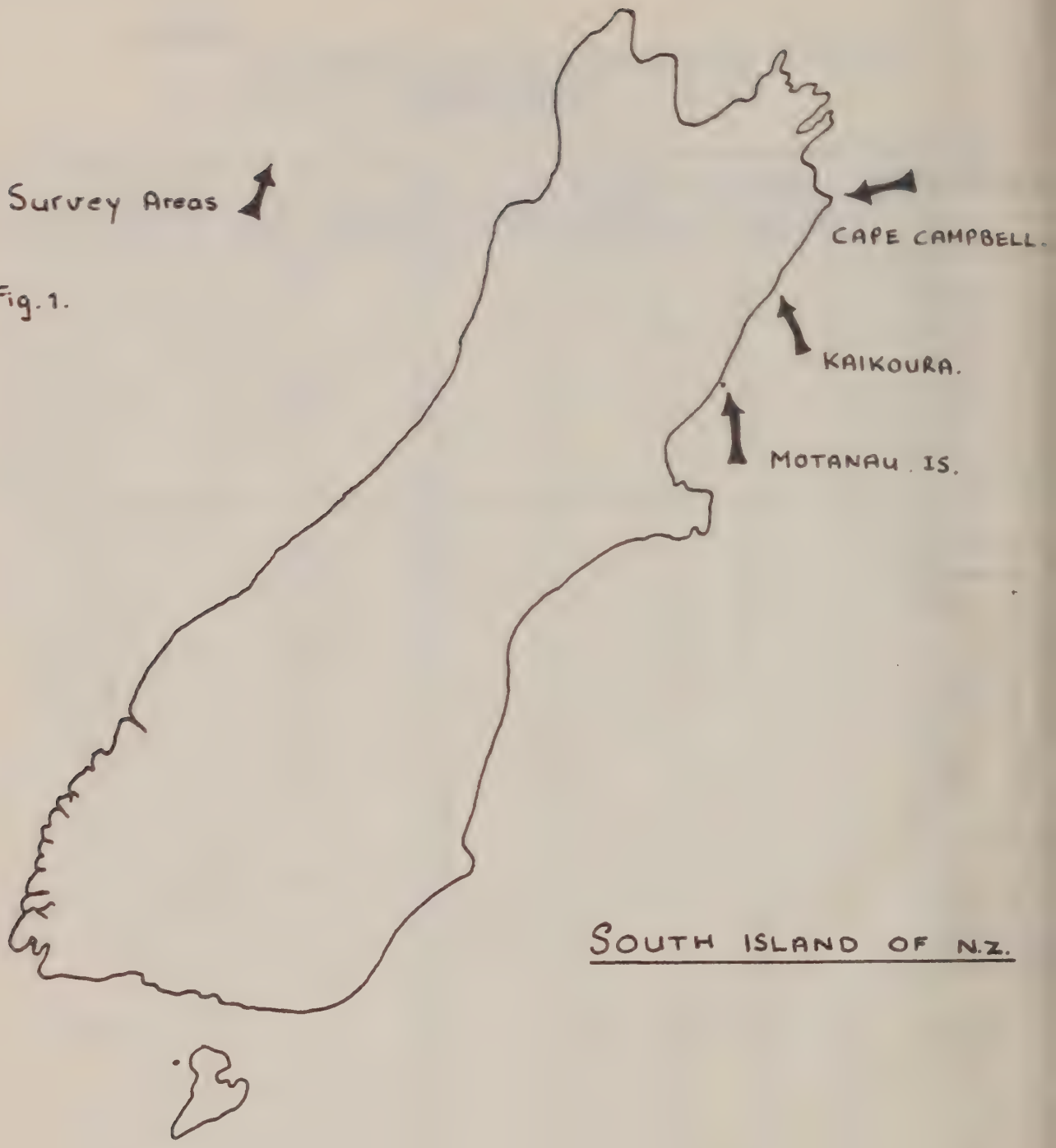
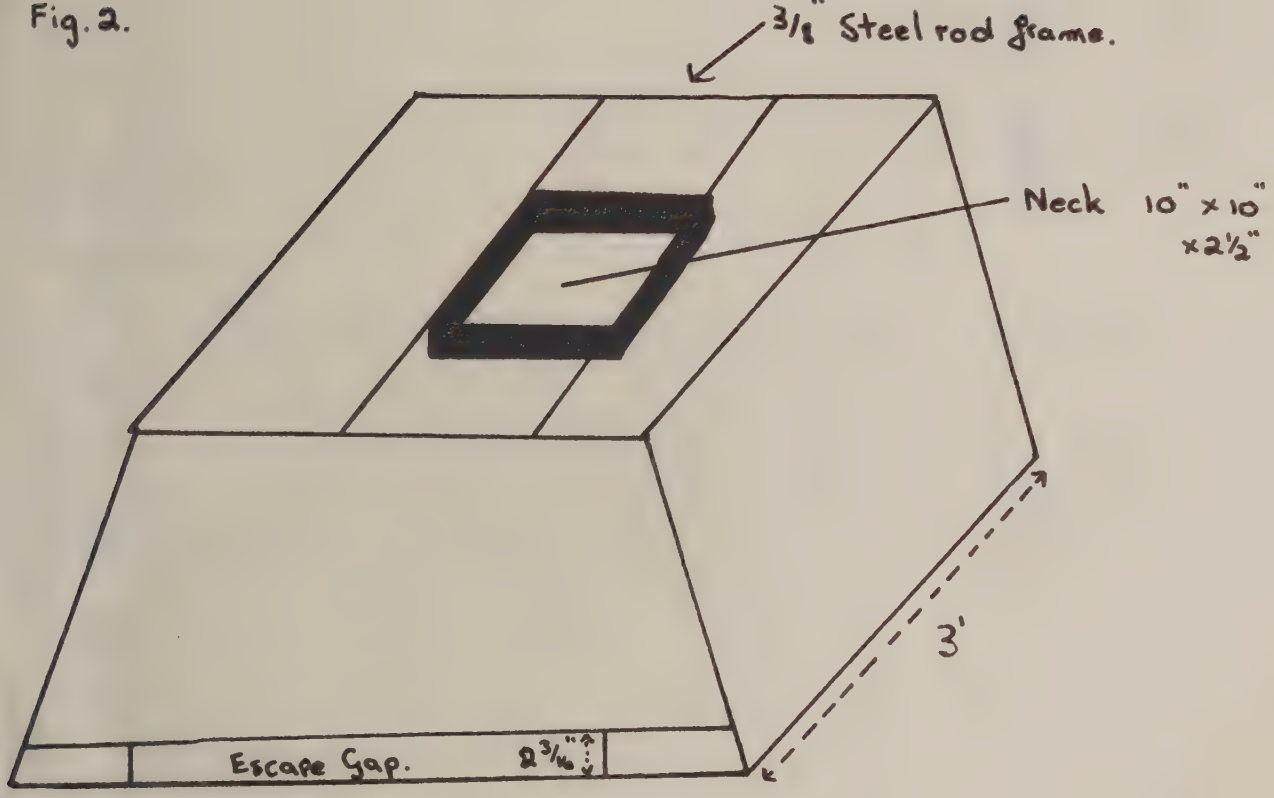

Survey Areas
CAPE CAMPBELL.
KAIKOURA.
MOTANAU. IS.
SOUTH ISLAND OF N.Z.

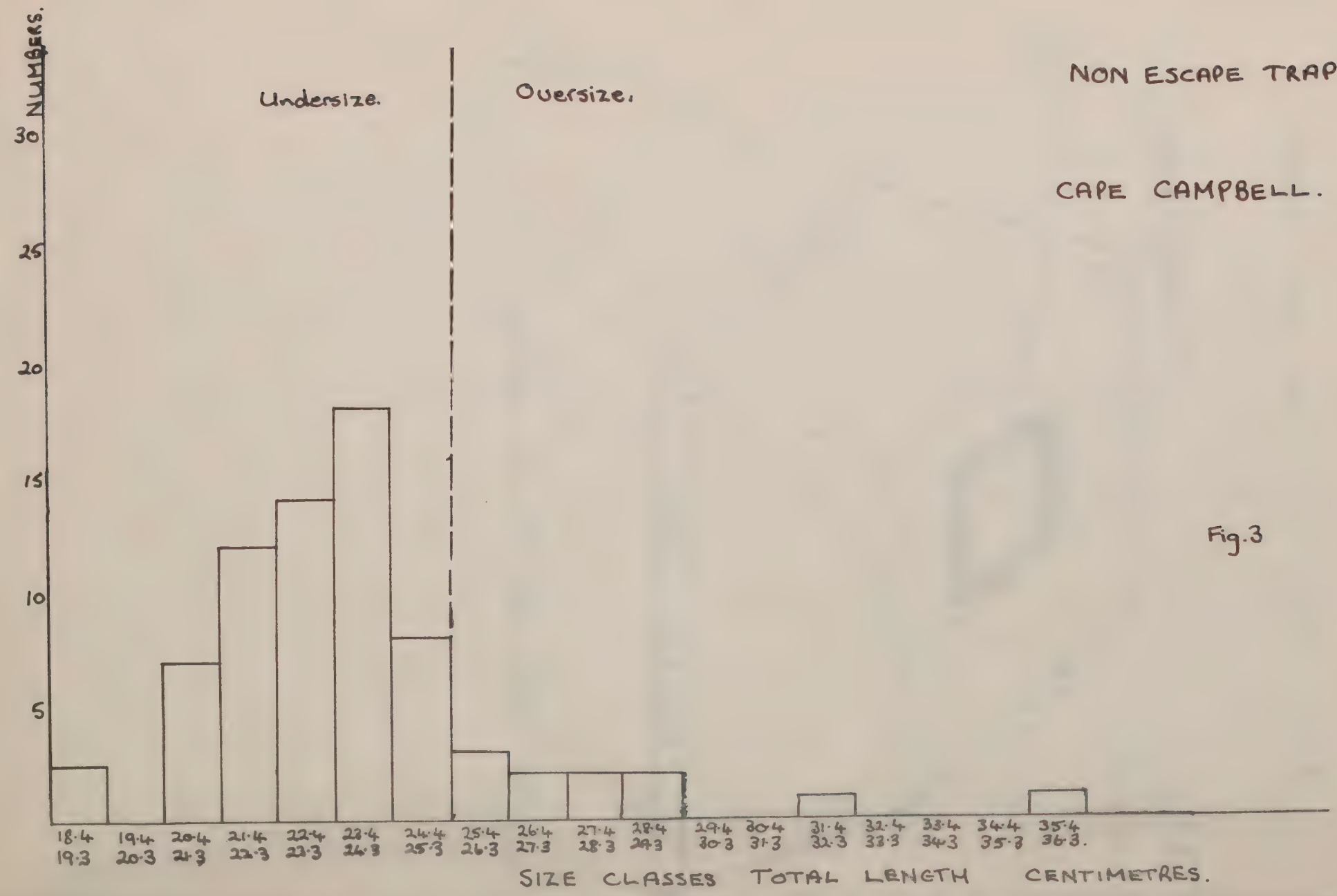
Fig. 1.

STEEL ESCAPE TRAPS USED IN ALL 3 AREAS.

Fig. 2.



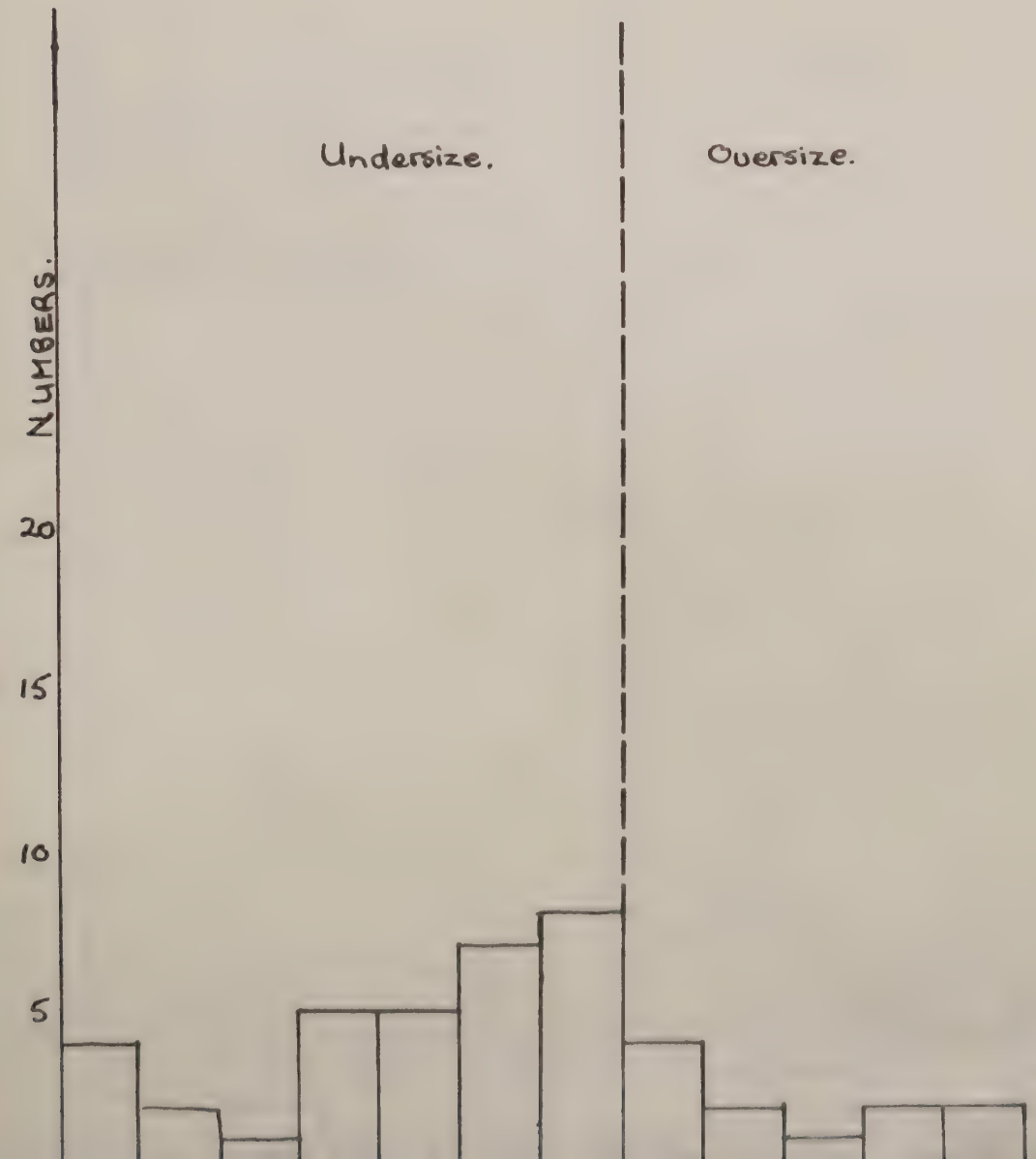
Trap covered with 1⅝" mesh wire netting.



NON ESCAPE TRAPS.

CAPE CAMPBELL.

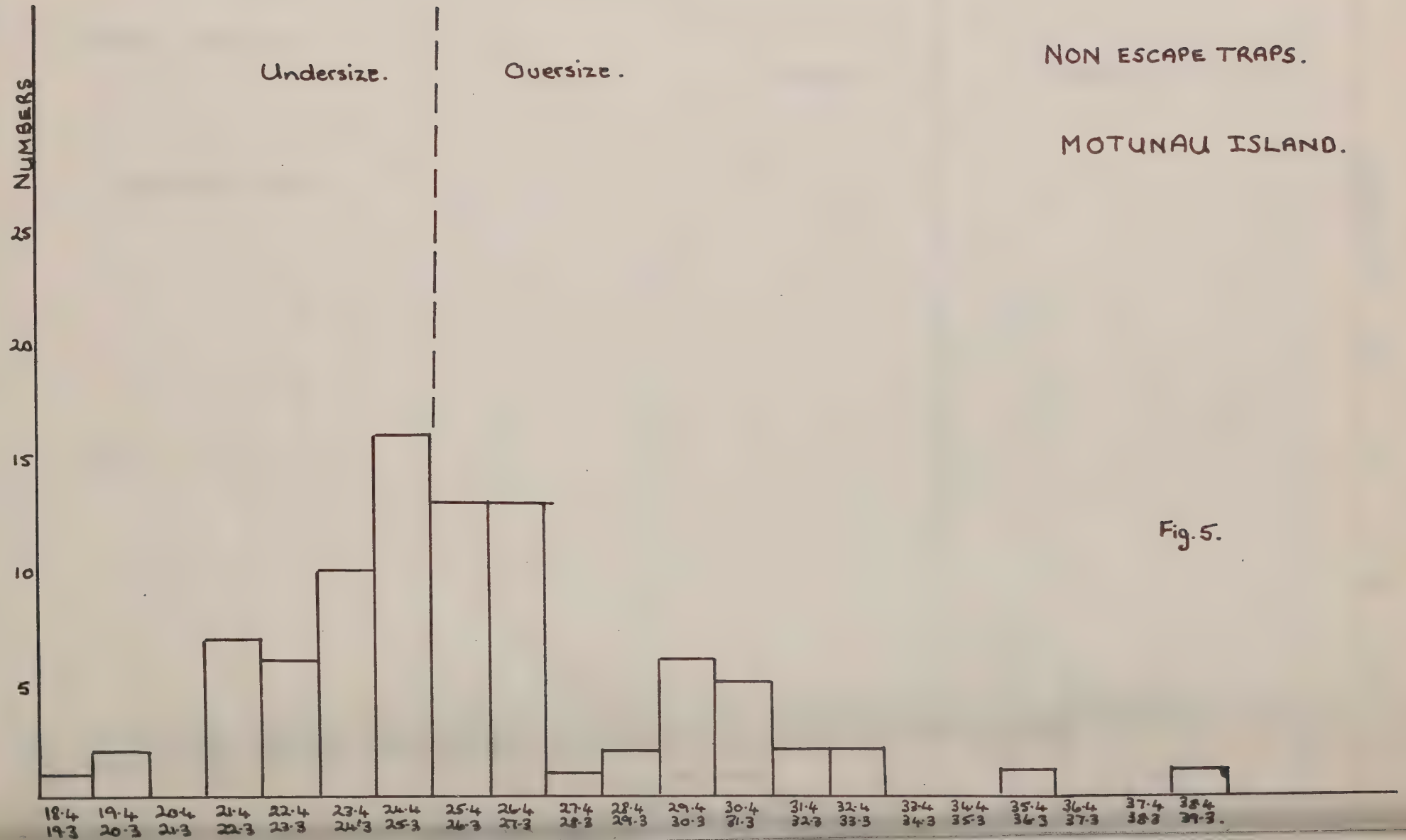
Fig.3



ESCAPE TRAPS.

CAPE CAMPBELL.

Fig.4.


NON ESCAPE TRAPS.
MOTUNAU ISLAND.
Undersize.
Oversize.
NUMBERS
25
20
15
10
5
18·4 19·3
19·4 20·3
20·4 21·3
21·4 22·3
22·4 23·3
23·4 24·3
24·4 25·3
25·4 26·3
26·4 27·3
27·4 28·3
28·4 29·3
29·4 30·3
30·4 31·3
31·4 32·3
32·4 33·3
33·4 34·3
34·4 35·3
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36·4 37·3
37·4 38·3
38·4 39·3.

Fig. 5.

ESCAPE TRAPS

MOTUNAU ISLAND.

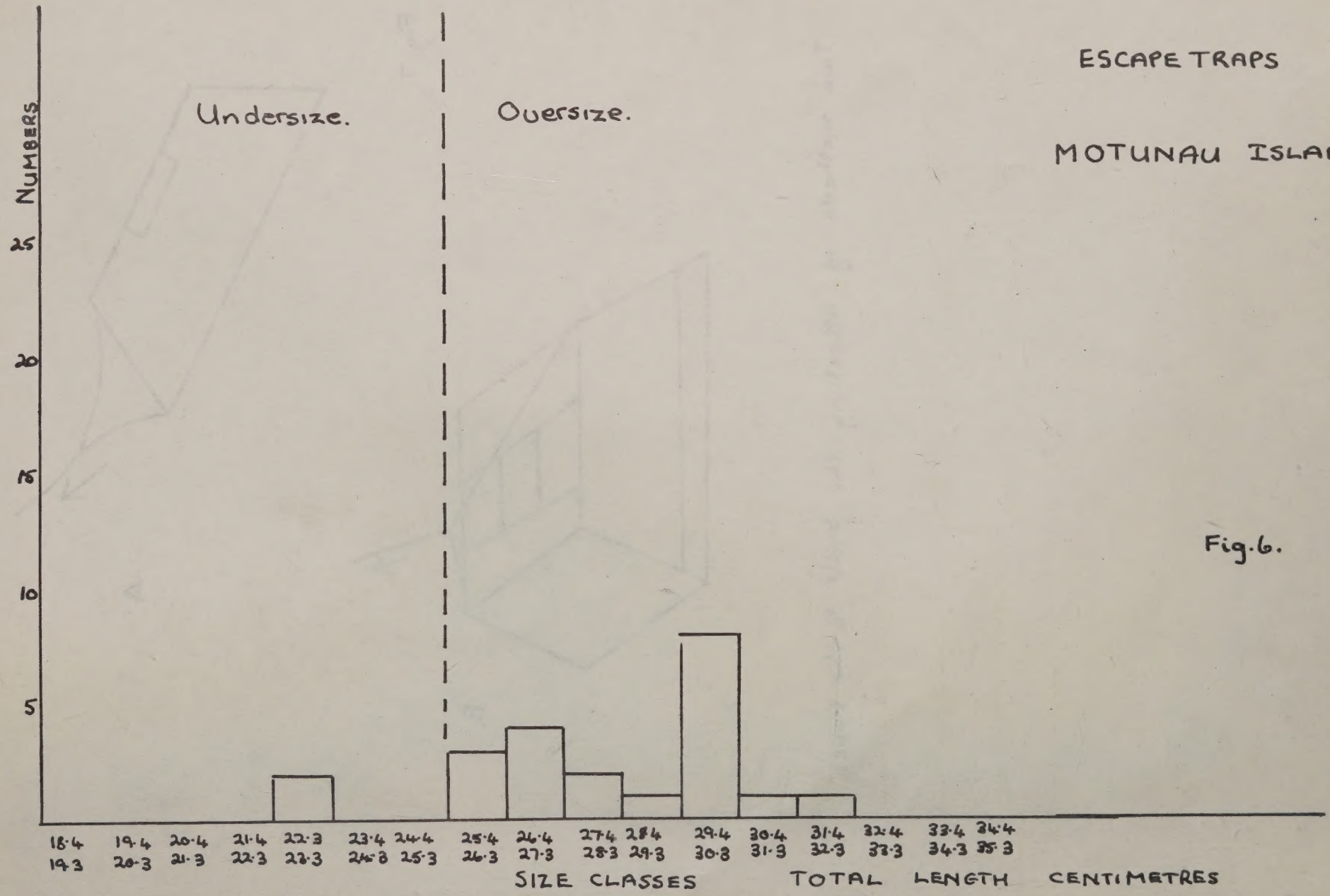
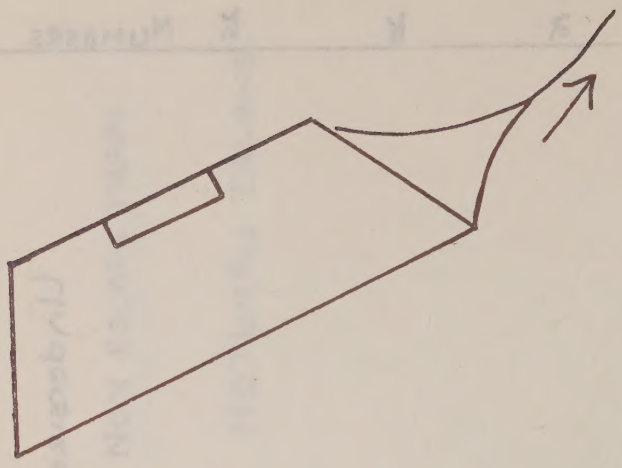
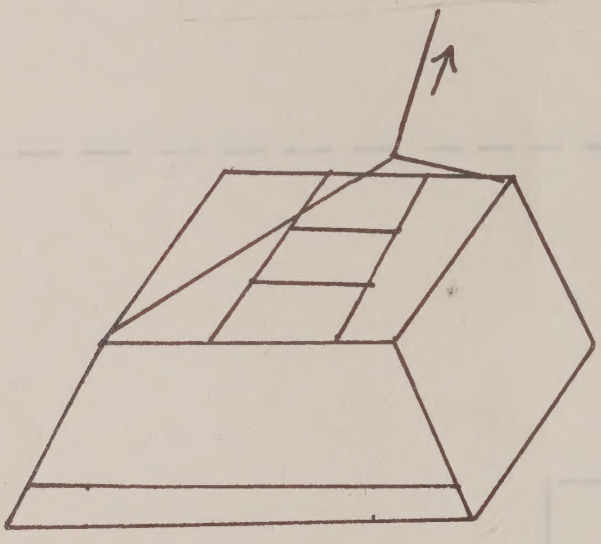


Fig.6.



A.



B.

Fig. 7.

Two methods of attaching the bridle to the traps.